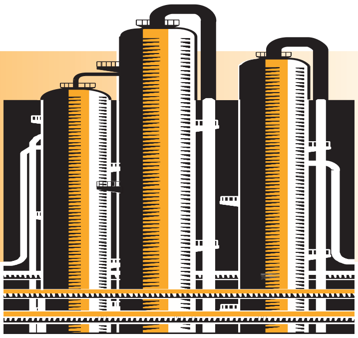
PETROLEUM

Project Fact Sheet



Gas Imaging for Advanced Leak Detection

Benefits

- Accelerated and simplified leak detection by optical imaging of gas plumes
- Wide-area and rapid imaging of hydrocarbon fugutive emissions
- Enhanced representation of gas flux rather than component point source data
- Efficient alternative to EPA method 21 leak measurement protocol
- Sensitivity to large leaks which constitute the majority of refinery flux
- Potential ability to conduct monitoring surveys more frequently

Applications

U.S. refineries are mandated to perform quarterly leak detection surveys of the entire operational system using the EPA Method 21 protocol. Gas imaging will provide more rapid alternative to this method. It employs the backscatter absorption gas imaging (BAGI) technique, in which a scene is illuminated by infrared laser radiation as it is imaged using an infrared video camera. Gases present in the imaged area that absorb at the laser wavelength appear as dark clouds in the generated video picture, which allows increased rapid identification of large leaks.

Gas imaging reduces resource loss at petroleum refineries by symplifying leak detection

A typical large U.S. refinery spends about one million dollars annually on quarterly leak surveys based on the Environmental Protection Agency (EPA) Method 21 leak detection protocol. By this method, hydrocarbon vapors near every potential leak point must be manually sampled using a hand-held “sniffer” gas sensor. This process is time-consuming and the concentrations measured do not always represent the leak flux due to spatial sampling errors. According to seperate EPA and American Petroleum Institute (API) studies, it has been demonstrated that the largest (top one percent) leaks detected produce more than 80 percent of the refinery emission flux. Thus, leak detection efforts can be optimized by focusing on the largest leaks. Gas imaging is sensitive to relatively large leaks and can accelerate leak detection by allowing many points to be inspected rapidly. Ultimately, when gas imaging has been developed into a person-portable system, it will provide a streamlined alternative to current leak detection activities, thus reducing cost. With a portable optical imaging system, energy savings will increase because inspections can be performed more frequently and leaks can be repaired more rapidly.

Currently, the gas imaging system has been moved out of the laboratory and is van-portable. Funding provided by the U.S. Department of Energy (DOE), Office of Industrial Technologies (OIT), is being utilized to develop a smaller system for increased portability by an individual performing tests throughout a refinery. Upon completion of this effort, the petroleum industry has proposed that refinery leak detection inspections be conducted more frequently to identify and repair large leaks, thus saving energy.

Gas Imaging Process

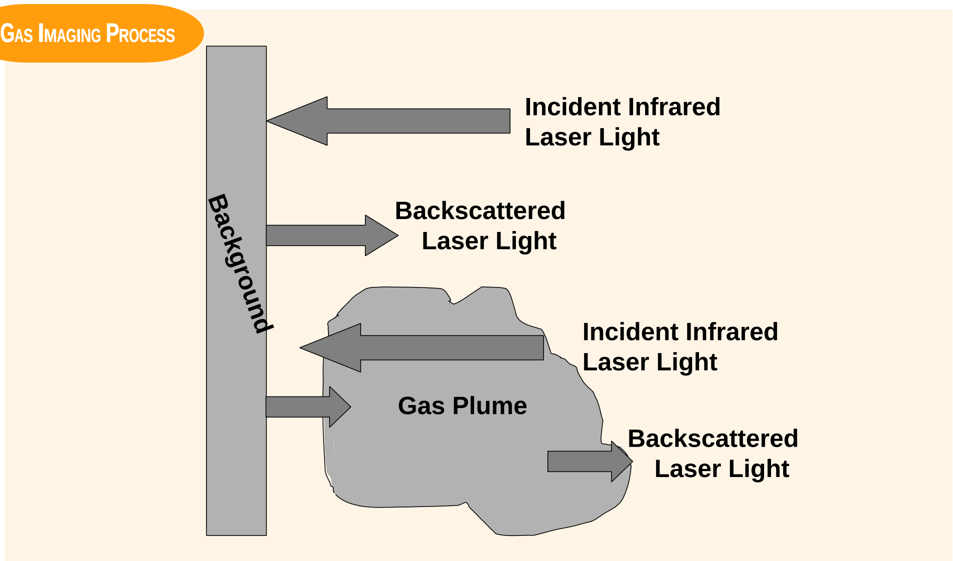


Diagram of the gas imaging process.

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ENERGY EFFICIENCY AND RENEWABLE ENERGY • U.S. DEPARTMENT OF ENERGY

Project Description

Goals: Development and sufficient miniaturization of the gas imaging system for increased transportability and usability by one person. This improved technique will be used to locate hydrocarbon losses from process piping components by optical imaging of gas plumes.

Develop optical imaging system that can be utilized for routine monitoring in process plants to locate hydrocarbon leaks from process piping components.

- Improve portability of current unit
- Design for safe operation in process plant atmospheres
- Insure user friendliness
- Confirm reliability
- Facilitate commercial availablity and industrial application

Demonstrate that new optical imaging technology is able to find hydrocarbon losses of the same magnitude as existing procedures.

- Conduct laboratory tests to establish monitoring condition effects
- Document preferred procedures for field use
- Test unit under actual process plant conditions

Progress and Milestones

- Development of prototype unit in 1996
- Field tested for natural gas in 1996/1997
- Successful demonstration in chemical plant during 1997
- Successful demonstration in refinery during 1999
- Availability of portable prototype expected in Winter 1999
- Planned laboratory testing of portable unit in Winter 1999
- Planned refinery test of portable unit in Spring 2000

Project Partners

American Petroleum Institute
Washington, DC

Laser Imaging Systems
Punta Gorda, FL

Sandia National Laboratories
Livermore, CA

U.S. DOE Office of Oil and Gas Technology
Washington, DC

U.S. Environmental Protection Agency
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